CLAIMS:

1   1.   A host coupled to a cluster fabric including one or more fabric-attached I/O

2   controllers, comprising:

3   a processor;

4   a memory coupled to the processor; and

5   an operating system provided with an I/O bus abstraction for the cluster fabric to report

6   multiple paths to a target fabric-attached I/O controller.

2.   The host as claimed in claim 1, wherein said operating system further comprises:

a kernel; and

a fabric bus driver to provide said I/O bus abstraction to the kernel for the cluster fabric to

report the multiple paths to the target fabric-attached I/O controller.

1   3.   The host as claimed in claim 2, wherein said fabric bus driver presents the cluster

2   fabric to the kernel as a local I/O bus, and presents one or more target fabric-attached I/O

3   controllers to the kernel as local I/O controllers.

1   4.   The host as claimed in claim 2, further comprising a host-fabric adapter provided

2   to interface the host to the cluster fabric.

1   5.   The host as claimed in claim 4, further comprising a fabric adapter device driver

2   provided to control operation of the host-fabric adapter.

1   6.   The host as claimed in claim 5, wherein said fabric bus driver creates a separate

2   device object for each port of the host-fabric adapter that can be used to communicate with the

3   target fabric-attached I/O controller and establish the multiple paths to the target fabric-attached

4   I/O controller.

7.   The host as claimed in claim 5, wherein said multiple paths are utilized for load

balancing I/O requests and/or for fault tolerance when one or more paths to the target fabric-

attached I/O controller fail.

8   The host as claimed in claim 5, wherein said fabric bus driver creates a single

2   device object for the target fabric-attached I/O controller even if multiple ports of the host-fabric

3   adapter can be used to communicate with the target fabric-attached I/O controller.

1   9.   An operating system for a host coupled to a cluster fabric including one or more

2   fabric attached I/O controllers, comprising:

3   a kernel;

1   an I/O manager operatively coupled to the kernel;

2   one or more I/O controller drivers operatively coupled to the kernel, each controller driver

3   specific for a specific type of I/O controller; and

4   a fabric bus driver operatively coupled to the I/O manager to provide an I/O bus

5   abstraction to the I/O manager for the cluster fabric to report multiple paths to a target fabric-

6   attached I/O controller.

10.   The operating system as claimed in claim 9, wherein said fabric bus driver appears

to the I/O manager as a local I/O bus driver.

11.   The operating system as claimed in claim 9, wherein said fabric driver presents the

cluster fabric to the I/O manager as a local I/O bus and presents the one or more fabric attached

I/O controllers as local I/O controllers connected to the local I/O bus.

1   12.   The operating system as claimed in claim 9, further comprising one or more local

2   I/O bus drivers operatively coupled to the I/O manager.

1   13.   The operating system as claimed in claim 12, wherein said local I/O bus drivers and

2   said fabric bus driver communicate with the I/O manager using a common set of procedures.

1   14.   A cluster comprising:

2   a cluster fabric;

3   a host including an operating system coupled to the cluster fabric;

4   an I/O controller attached to the cluster fabric; and

5   a fabric manager coupled to the cluster fabric, for assigning I/O controllers in the cluster

6   fabric to at least said host and sending messages to said host indicating that the I/O controller has

7   been assigned;

8   wherein said operating system including a fabric bus driver provided to report multiple

9   paths to a target fabric-attached I/O controller.

15.   The cluster as claimed in claim 14, wherein said operating system further

comprises a kernel, and said fabric bus driver provided said I/O bus abstraction to the kernel for

the cluster fabric to report the multiple paths to the target fabric-attached I/O controller.

1   16.   The cluster as claimed in claim 14, further comprising a host-fabric adapter

2   provided to interface the host to the cluster fabric, and a fabric adapter device driver provided to

3   control operation of the host-fabric adapter.

1   17.   The cluster as claimed in claim 15, wherein said fabric bus driver creates a separate

2   device object for each port of the host-fabric adapter that can be used to communicate with the

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1   target fabric-attached I/O controller and establish the multiple paths to the target fabric-attached

2   I/O controller.

1   18.   The cluster as claimed in claim 17, wherein said multiple paths are utilized for

2   loading balancing I/O requests and/or for fault tolerance when one or more paths to the target

3   fabric-attached I/O controller fail.

1   19.   The cluster as claimed in claim 15, wherein said fabric bus driver creates a single

2   device object for the target fabric-attached I/O controller even if multiple ports of the host-fabric

3   adapter can be used to communicate with the target fabric-attached I/O controller.

1   20.   The cluster as claimed in claim 14, wherein said fabric manager comprises:

2   a fabric services to detect the connection or presence of the target fabric-attached I/O

3   controller and to assign a network address to the target fabric-attached I/O controller; and

4   an I/O controller manager coupled to the fabric services to assign the target fabric-

5   attached I/O controller to said host and to send messages to said host indicating that the target

6   fabric-attached I/O controller has been assigned.

1   21.   A computer usable medium having computer readable program code means

2   embodied therein for use in a host system to report multiple paths to a target fabric-attached agent

1   via a cluster fabric, said computer readable program code means comprising:

2   a fabric bus driver provided to create and report multiple paths to a target fabric-attached

3   I/O controller via the cluster fabric, and

4   a fabric adapter device driver provided to interface to the cluster fabric for enabling

5   reporting the multiple paths to the target fabric-attached I/O controller.

1   22.   A method of initializing a host to report multiple paths to a target agent via a

2   cluster fabric, comprising:

3   loading an operating system kernel into a memory;

4   loading an I/O manager into the memory;

5   loading a local I/O bus driver and a fabric bus driver providing a local I/O bus abstraction

6   for the cluster fabric into the memory;

7   enabling the local I/O bus driver to identify any local I/O controllers connected to a

8   corresponding local I/O bus;

9   enabling the fabric bus driver to identify any fabric-attached I/O controllers assigned to the

10   host, and report the identified local I/O controllers connected to the local I/O bus and the

11   identified fabric-attached I/O controllers to the I/O manager;

12   loading an I/O controller driver into the memory for each reported I/O controller; and

13   enabling the fabric bus driver to create and report multiple paths to a target fabric-attached

14   I/O controller via the cluster fabric.

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1   23.   The method as claimed in claim 22, wherein said identified local I/O controllers

2   connected to the local I/O bus and said identified fabric-attached I/O controllers to the I/O

3   manager are reported using a common set of procedures or commands.

1   24.   A method of initializing a host to report multiple paths to a target agent via a

2   cluster fabric, comprising:

3   loading an operating system kernel into a memory;

4   loading an I/O manager into the memory; and

5   loading a local I/O bus driver and a fabric bus driver providing a local I/O bus abstraction

6   for the cluster fabric into the memory;

7   enabling the local I/O bus driver to identify any local I/O controllers connected to a

8   corresponding local I/O bus; and

9   enabling the fabric bus driver to identify any fabric-attached I/O controllers assigned to the

10   host, identifies all paths to a target fabric-attached I/O controller, create one instance of an I/O

11   controller driver stack for each path to the target fabric-attached I/O controller, and report all

12   multiple paths to a target fabric-attached I/O controller via the cluster fabric.

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